

# The Nova V5584 Sgr: A Short Review

R. Poggiani <sup>1</sup>

<sup>1</sup>Department of Physics, Università di Pisa

Corresponding author: [rosa.poggiani@df.unipi.it](mailto:rosa.poggiani@df.unipi.it)

## Abstract

The nova V5584 Sgr was discovered during 2009 October. It has been monitored in different domains of the electromagnetic spectrum: optical, infrared and X-rays. The optical and infrared observations suggest that V5584 Sgr is a Fe II nova that formed dust. No X-ray emission was observed around the time of maximum.

**Keywords:** cataclysmic variables -novae - optical - spectroscopy - individual: V5584 Sgr.

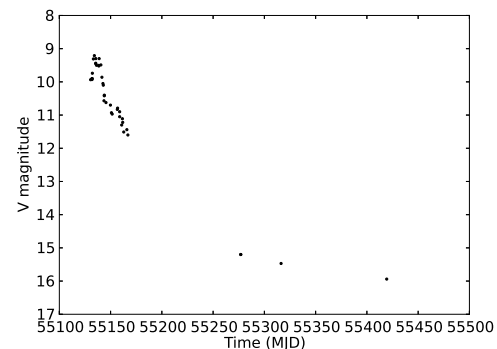
## 1 Introduction

Nova Sagittarii No. 4 was discovered by Nishiyama and Kabashima (2009) on 2009 October 26 and later designated V5584 Sgr (Samus, 2009). V5584 Sgr is a classical example of multi-wavelength astrophysics, since it has been observed in different parts of the electromagnetic spectrum: optical, infrared and X-rays. The very early optical spectroscopic observations secured by Kinugasa et al. (2009), Maehara et al. (2009), Fujii (Maehara et al., 2009), Munari et al. (2009) in the optical and by Raj et al. (2009) in the infrared showed that V5584 Sg is a Fe II nova, in the context of the classification by Williams et al. (1991), Williams (1992). Spectra secured by Russell et al. (2010) during 2010 February showed that dust formation had occurred. Poggiani (2011) has monitored V5584 Sgr during the late decline. V5584 has been investigated in the optical domain by the Stony Brook/SMARTS Consortium (Walters et al., 2012). The present paper reviews the history of V5584 Sgr observations.

## 2 Light Curve

The photometric evolution and the main parameters of V5584 Sgr has been reported by Poggiani (2011) and will be briefly summarized below for completeness. The V band light curve is reported in Fig. 1. The epoch of maximum is MJD=55134.208 (2009 October 29), while the decline time by two magnitudes is  $27 \pm 2$  days, making V5584 Sgr a moderately fast nova, according to the classification by Payne-Gaposchkin (1957). The reddening of V5584 Sgr is  $0.82 \pm 0.12$ . The estimated distance of V5584 Sgr is in the interval 5.8–7.1 kpc. The absolute magnitude at maximum is in the range  $-7.2 \dots -7.7$ , while the white dwarf mass is in the range 0.8–0.9  $M_{\odot}$ . All parameters extracted by the analysis of the

light curve suggest that V5584 Sgr is a Fe II nova, according to the classification by Della Valle & Livio (1998). The spectroscopic observations described below will provide further evidence for the classification.



**Figure 1:** V band photometry of V5584 Sgr

## 3 Optical Spectroscopy

Spectroscopic observations of V5584 Sgr around maximum have been secured by different authors. Kinugasa et al. (2009) observed H $\alpha$  and Fe II lines in emission with P Cyg profiles on 2009 October 27. The presence of H $\alpha$  in emission was confirmed by Maehara et al. (2009) on the same day. Munari et al. (2009) observed a highly reddened absorption continuum on October 28, with H $\alpha$  and Fe II showing an emission component and the same continuum with faint emission from Balmer and Fe II multiplets on October 29. It was suggested that V5584 Sgr was a Fe II nova caught around maximum, according to the classification by Williams et al. (1991), Williams (1992). V5584 Sgr has also been observed at the Higashi-Hiroshima Observatory with the



Infrared observations of V5584 Sgr have been secured by Raj et al. (2009) on October 29 at Mt. Abu telescope showed Paschen, Brackett, O I, C I, N I lines with P Cyg profiles, whose components were separated by about 550-650 km/s. The emission components strengthened, while the absorption components faded by November 3. The transitions observed in spectra are typical of the Fe II class novae, providing an independent confirmation of the classification of V5584 Sgr. The following observations in the infrared were secured after the seasonal gap. On 2010 February 10 Russell et al. (2010) observed V5584 Sgr in the region 3-14  $\mu\text{m}$  with AEOS telescope, discovering that the nova had formed dust since the previous observations. The infrared continuum was dominated by the thermal emission of the dust at a temperature of  $880 \pm 50$  K; no details of the dust composition or the derivation of the temperature are reported. The above infrared observations provide a clue that was not available due to the lack of observations during the seasonal gap.

## 5 X-Ray Observations

The importance of X-ray observations of novae has been addressed by several authors, also at this conference (Ness, 2013), (Orio, 2013). V5584 Sgr has been observed with the Monitor of All-Sky X-ray Image (MAXI) (Shimano et al., 2010). The system is on board of ISS and uses two high sensitivity X-ray detectors, the Gas Slit Camera (32 CCD chips) and the Solid State Slit Camera (a Xenon filled proportional counter). MAXI scans all sky every 92 minutes. Shimano et al. (2010) have searched the prompt X-ray emission at the ignition of the thermonuclear runaway. The authors suggested that classical novae could emit X-rays at the outburst in analogy to the type I X-ray bursts of X-ray binaries. The observations included several peculiar novae: V1723 Aql, V407 Cyg, V2673 and V2674 Oph, V1722 Aql, KT Eri, V496 Sct. The authors have focused on the archive data in the energy band 1.5-4 keV, the lowest energy available, assuming that nova outbursts preferentially emit soft X-rays. They also investigated the 4-10 keV and 10-20 keV bands. No prompt emission was detected in the three bands for any nova. There are no reported X-ray observations of V5584 Sgr at later stages, when supersoft emission could have occurred.

## 6 Conclusions

V5584 Sgr is a standard Fe II nova. The synergy of observations in different domains allowed a classification of the spectral class and the discovery of dust production during the seasonal gap.

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X-rays would be expected. I just wanted to comment that in this band we would not expect to see super-soft X-ray emission which normally does not go above 1 keV.

**ROSA POGGIANI:** The MAXI astronomers stated that they were looking for soft X-ray emission in the above energy range. I agree that to detect the X-ray emission you are mentioning you should use another instrument

## DISCUSSION

**MARTIN HENZE:** You described X-ray observations and mentioned soft band of 1.5-4 keV in which soft

**JAN-UWE NESS:** The MAXI collaboration was looking for prompt emission.